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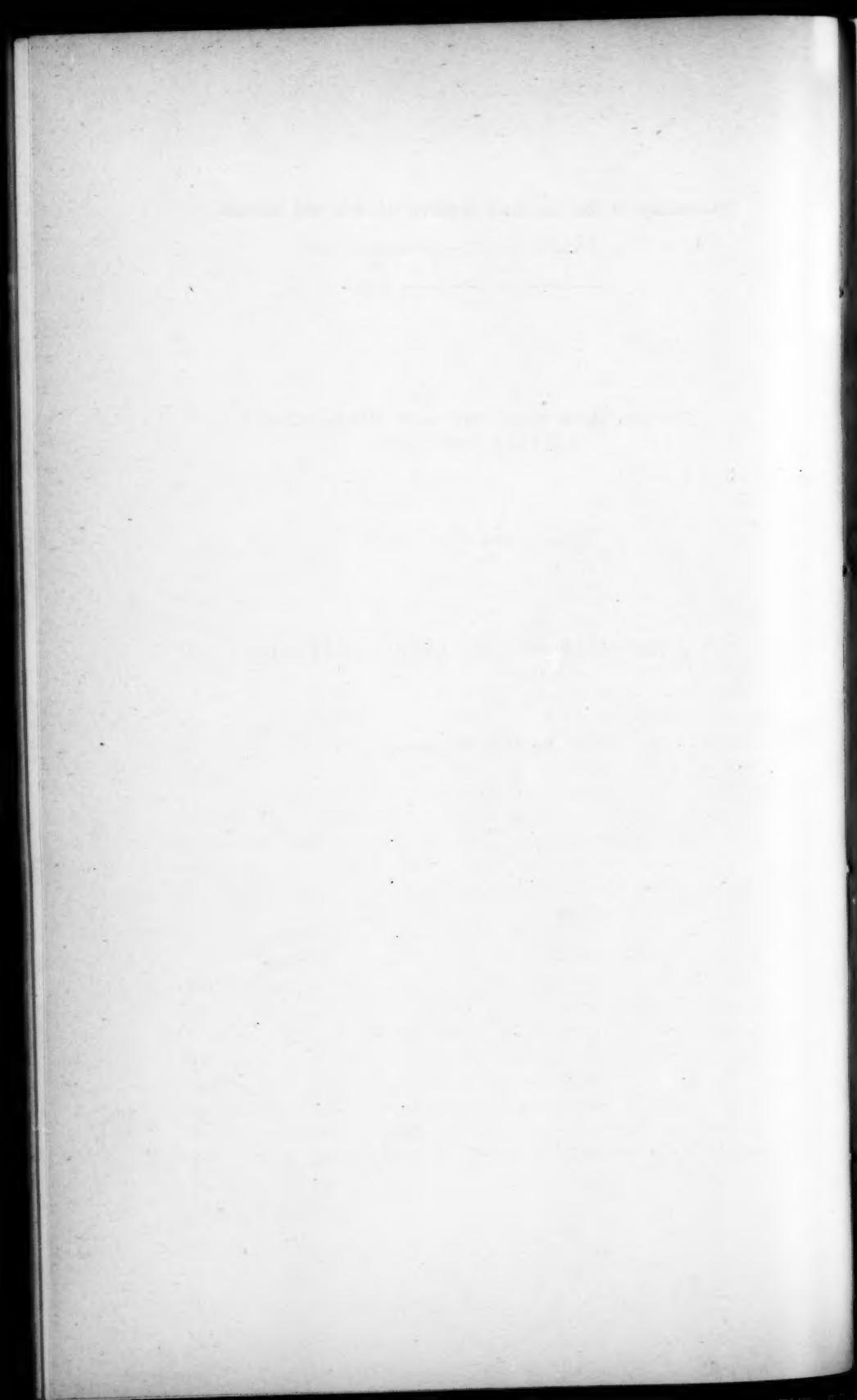
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A REVISION OF THE GENUS FLAVERIA.

BY J. R. JOHNSTON.



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Presented by B. L. Robinson April 8, 1908. Received October 12, 1908.

NOT since 1836, when A. P. DeCandolle enumerated in the *Prodromus*, v. 635, only four species of *Flaveria*, has there been a revision of the genus. Since DeCandolle's time there have been over a dozen different plants published as new *Flaverias*, seven of which have proved to be good species. The need of another revision so far as the Mexican species are concerned is mentioned by Hemsley in the *Biol. Cent.-Am. Bot.* ii. 215 (1881-82), and the confusion in identification of certain species, together with the recent accumulation of specimens in the herbaria of this country, have emphasized its need.

The history of the genus is considerably complicated by the diverse views expressed by the early writers, who treated its species. The name *Flaveria* (from the Latin *flavus*, golden yellow, the plants having been used to dye yellow) was first proposed by A. L. de Jussieu (1789), in his *Genera Plantarum*, for two plants from Chili and Peru. His meagre descriptions and the fact that he omitted specific names for the plants, and distinguished them from each other only by the spicate inflorescence of the Peruvian plant and the glomerate capitate heads of the Chilian, have given rise to different ideas concerning the type plant as well as its name.

The reference of Jussieu to Feuille, *Journ. Obs. Physiques, Mathematiques et Botaniques*, iii. 18, t. 14, in speaking of the Chilian species, leaves no doubt that at least this one of the species described was the plant called "contrayerba" by the natives of Chili. Cavanilles in his *Icones Plantarum*, i. 2, t. 4 (1791), also referred to Feuille's figure in describing *Milleria Contrayerba*, thus making it synonymous with the Chilian plant of Jussieu, who had distinguished *Flaveria* from *Milleria* merely because of the supposed absence of ligulate flowers. These were, nevertheless, found by Cavanilles, and in consequence he returned to the name *Milleria*, thus reducing *Flaveria* to the rank of a synonym. Ruiz

and Pavon, who likewise had to deal with this "contrayerba" of South America in writing their *Flora Peruviana Prodrom.* 114 (1794), asserted rightly that from its characters it could not belong to the genus *Milleria*, hence they proposed a new name *Vermifuga*, but it was not until later in their *Systema Vegetabilium Fl. Peruv. et Chil.* 216 (1798), that they added the specific name "corymbosa." Persoon in his *Synopsis Plantarum*, ii. 489 (1807), referred both *Milleria Contrayerba*, Cav., and *Vermifuga corymbosa*, R. & P., to *Flaveria Contrayerba*, the name which has been used up to the present time.

In the meantime, however, Gmelin in his *Systema*, 1549 (1796), reverted to *Flaveria* and published the specific binomials *F. chilensis* and *F. peruviana* for the two original plants of Jussieu. It is thus evident that *F. chilensis*, Gmel., is the first properly named species of *Flaveria*, and it is also clear that this was the Chilian plant of Jussieu, the "contrayerba" of the Chilians. It may be said further in regard to Gmelin's two names, that later writers have quite correctly called *F. peruviana* a synonym of *F. Contrayerba*, Pers., but that they have also with little reason considered *F. chilensis* a synonym of *F. angustifolia*, Pers., which was first described as a *Milleria* by Cavanilles in his *Ic. Plant.* iii. t. 223. This opinion seems to have been based on very slight grounds; in fact, merely upon the incomplete description of the form of inflorescence. The Chilian plant is described as having a glomerate capitate inflorescence which fits *F. angustifolia* well, but Jussieu refers the Chilian plant to that of Feuille, the illustration of which agrees fairly well with the appearance of *F. chilensis*, Gmel., and is undoubtedly the "contrayerba." Moreover, "angustifolia" is typically a Mexican plant, having never been reported, so far as I can make out, in South America.

To the Peruvian plant, however, Jussieu ascribes a spicate inflorescence which does fairly well for some species of *F. Contrayerba*, Pers., or, using the earlier name, *F. chilensis*, Gmel. Thus, it seems probable that both of Jussieu's specimens may properly be referred to *F. chilensis*, Gmel., and that *F. peruviana*, Gmel., may be considered its synonym. Although Jussieu identified his plants with *Milleria chiloensis* in *Hortus Regius Parisiensis*, the first instance of a specific name under *Flaveria* is that of *F. chilensis*, Gmel., so that that name should take precedence over all others.

F. chilensis, Gmel., is then the type plant of the genus, and *F. angustifolia*, Pers., is the second good species published in the group. A detailed study of *F. Contrayerua*, Cav. (*F. Contrayerba*, Cav.) was undertaken by Sprengel in *Schrad. Journ. Bot.* pt. 2, 186, t. 5 (1800).

As he concluded both that the plant he had at hand was not a *Milleria*, and that *Flaveria* was not a good genus, he proposed a new name, *Brotera*, so that the plant stood as *Brotera Contrayerva*, Spreng. The plant described and illustrated by Sprengel is, however, an entirely different plant from *Milleria Contrayerba*, Cav. Widenow (1804) in Species Plantarum, iii. pt. 3, 2393, having previously used the name *Brotera* for a genus (Cardopatiuum, Juss.) published *Nauemburgia trinervata* for Sprengel's plant, not for Cavanilles's. Lagasca, however, Gen. et Sp. Nov. 33, no. 406 (1816), named a plant *Flaveria repanda*, which Sprengel in 1826, *Systema Vegetabilium*, iii. 500, identified with both *Nauemburgia* and *Brotera*. Sprengel also enumerated *F. Contrayerba*, Pers., *F. angustifolia*, Pers., and *F. linearis*, Lag. As late as 1832, Lessing, *Synopsis Generum Compositarum*, 235, maintained *Nauemburgia* distinct from *Flaveria*, and DeCandolle, *Prod. v.* 635 (1836), retained *Broteroa* (*Brotera*, Spr.) *trinervata*. As the distinction between *Brotera* (or its synonym *Nauemburgia*) and *Flaveria* consists merely in the presence of setae upon the receptacle, a character variable in some genera of the Compositae, it alone is not sufficient to separate the two. As other characteristics of the plants correspond very well, it has seemed best to unite the two genera in this revision.

Since the publication of the above species, as has been said, seven good species have been added to the genus, and about as many more plants have been given new names under *Flaveria*, which have subsequently proved identical with existing species or not to belong to the genus at all. The abundance of material at hand has afforded opportunity for better characterizing the species, for increasing the known range of some of them, and it has also furnished sufficient evidence for naming one variety and four new species of plants which have hitherto been placed with others.

It may be said that the genus groups itself fairly well into subdivisions; for example, *F. australasica* and *F. repanda* are similar in habit, and are the only two having setae upon the receptacle. Those whose heads have three bracts also form a characteristic group, which, however, passes into the group characterized by five bracts. Besides those with perennial roots which do not resemble each other at all, there are several other exceptional forms, as *F. anomala*, which has the three bracts with bulbous bases, and *F. chloraefolia*, which is the only species with conspicuously perfoliate leaves. In the subgroup, which is characterized by possessing three involucral bracts, however, there has been considerable confusion in separating the species, due to the similarity sometimes in habit and again in floral structure. *F. chilensis* is the only one of this group having a

distinctive ligulate flower, the ligule being slender, upright, and short, compared with the others, which are oval, usually reflexed, and large, the specific distinctions between the latter consisting mainly in habitat characters. Again, the group characterized by five involucral bracts has an element of confusion in it, due rather to the extreme variation from a shrubby form, growing on hot and dry sea beaches, to herbaceous forms found in wetter places. In one species, *F. linearis*, as heretofore understood, may be found forms possessing no regular branching at all, and forms having the dichotomy characteristic of the genus. There is also a variation from plants having the leaves mostly whorled, about .2 cm. wide and 2 to 3 cm. long, to others having the leaves prevailingly opposite, .5 to 2.5 cm. wide and 4 to 12 cm. long. Moreover, the internodes in plants of this so-called species vary from 1.5 to 5 cm. long, a difference, however, which may well be due to individual environment. Notwithstanding these differences, however, among the species, the genus, as a whole, is one easily recognized and not likely to be confounded with others.

The characteristic habitat is shown by *F. longifolia*, which grows in alkaline meadows of San Luis Potosi, Mexico. The genus, for the most part, is Mexican, though *F. australasicæ* is found only in Australia, and *F. repanda* and *F. chilensis* have a range from southern United States to Chili and Argentine Republic. *F. linearis*, also, grows in Yucatan, Cuba, and Florida on the sandy beaches, and *F. campestris* is confined, so far as is known, to the western central United States, Arkansas to Colorado, growing in alkaline soil. The remainder, with the exception of the Florida species *F. floridana*, occur in Mexico. *F. angustifolia* is found in rich valleys of Mexico and ascends to 2,000 or 2,500 m. altitude, and *F. chilensis* has been reported at the same height in Peru.

So far as uses are concerned, *F. chilensis*, Gmel., is the only plant in the genus which has been reported of any economic value. Feuille, Ruiz, and Pavon, all speak of its medical properties. The latter say that the natives bruise the plants in a salt brine and apply to putrid ulcers to drive out worms. Feuille states that, boiled in water, it makes a beautiful yellow stain.

In preparing this paper the library and specimens of the Gray Herbarium have been consulted, as well as material from the private herbarium of Mr. John Donnell Smith, from the herbarium of the Missouri Botanical Gardens, from the Engelmann Herbarium, and from the United States National Herbarium. To those who have so kindly given the use of these, and especially to Professor B. L. Robinson, under whose super-

vision the writer has been working, and to Miss M. A. Day, librarian at the Gray Herbarium, many thanks are due.

FLAVERIA. Heads small, heterogamous or homogamous, 1- to 15-flowered, rays usually only one. Involucral bracts 2 to 8, subequal, sometimes with two smaller exterior bracts. Receptacle small, naked or setose. Achenes linear-oblong, glabrous, 8- to 10-ribbed, black. Corolla ♀ ligulate, from $\frac{1}{2}$ length of achene to 3 or 4 times as long, entire, emarginate or tridentate, upright or reflexed. Corolla ♂ regular, turbinate, 5-parted. Corolla tubes villous or not, the hairs consisting of 6 to 12 short thick cells. Anthers at base obtuse, entire. Apex with a conical appendage. Style of ♂ flower 2-parted, reflexed, obtusely rounded. Pappus usually none, in one species broad, scale-like, dentate, or fimbriate.

Herbs glabrous or puberulous, often yellowish or rubescens. Leaves opposite, narrow, entire or dentate. Capitula narrow, sessile or with short pedicels, borne in dense cymes or glomerules, which are pedunculate or sessile, corymbose-paniculate or solitary at tips of branches. Corolla pale to deep yellow. — Juss. Gen. Pl. 186 (1789); Gmel. Syst. 1269 (1791); Willd. Enumeratio, 941; Persoon, Synopsis Plantarum, ii. 489; Spreng. Syst. iii. 500, n. 2737; Less. Synopsis Generum Compositarum, 235; DC. Prod. v. 635; Torr. & Gray, Fl. N. Am. ii. 360; Benth. & Hook. f. Gen. Pl. ii. 407; Hemsl. Biol. Cent.-Am. Bot. ii. 215; Hoffm. in Engl. & Prantl, Nat. Pflanzenf. iv. Abt. 5, 258. *Vermifuga*, Ruiz & Pavon, Flora Peruviana Prod. 114, t. 24 (1798-1802). *Milleria*, pro parte, Cav. Ic. Pl. i. 2, t. 4 (1791). *Broteria*, Spreng. in Schrad. Journ. iv. 186, t. 5 (1800). *Nauemburgia*, Willd. Sp. Pl. iii. 2393 (1804). *Broteroa*, DC. Prod. v. 636 (1836). *Selloa*, pro parte, Nutt. Am. Journ. Sc. v. 300 (1822). *Gymnosperma*, pro parte, DC. Prod. v. 312 (1836).

§ 1. Receptacle setose.

* Leaves linear to lanceolate, entire or serrulate; Australian.

1. F. **AUSTRALASICA**, Hook. Herbaceous, 30 to 60 cm. high; stem striate, glabrate: leaves with base dilate, linear-lanceolate, entire or serrulate, glabrous, 3-nerved, .2 to 1.4 cm. wide, 2 to 7.5 cm. long: heads densely glomerate, glomerules 1 to 2.5 cm. wide, subinvolucrate: involucral bracts 2 to 4: corolla ♀ ligulate, lamina equalling tube or nearly so, upright or oblique, entire, emarginate or tridentate, corolla tube slightly villous: achenes nearly equal, 2.25 mm. long. — In Mitchell's Journ. Trop. Austral. 118; Mueller, Frag. i. 183. — **N. AUSTRALIA**,

Nichol Bay, N. W. coast, *F. Gregory's* Expedition; Victoria River and Hooker's Creek, *F. Mueller* (hb. Gr., hb. U. S.); islands of the Gulf of Carpentaria, *R. Brown*; in the interior, *M'Douall Stuart's* Expedition; Albert River, *Henne*; Balonne River, Quesneland, *Mitchell* (hb. Gr.): these acc. Benth. Fl. Aust. iii. 546 (1866).

** Leaves lanceolate to elliptical; American.

2. *F. REPANDA*, Lag. Herbaceous, stem 30 to 120 cm. high, green or reddish, dichotomous, striate, glabrate: leaves opposite, lanceolate, prominently 3-nerved, apex rounded or acute, 2 to 9 cm. long, .6 to 2.5 cm. wide, the base of the lower leaves tapering into a sort of petiole, the two opposite ones being connate at the stalk; the upper leaves are decidedly connate; leaves in three pairs about inflorescence; lanceolate leaves serrate, elliptical leaves repand-dentate: heads usually 1-flowered, gathered in dense axillary or terminal clusters: ♀ bracts 1 to 2, usually 2, both concave, acute or rounded at apex, even emarginate, one larger than the other: corolla subligulate, emarginate, entire or tridentate, a little over .1 cm. long, lamina the length of the tube, oblique, entire corolla a little over $\frac{1}{2}$ length of achene, lower part of tube villous: achene scarcely .1 cm. long: ♂ bracts 1 to 2 as in ♀; corolla tube narrow becoming full at throat, lobes acute, reflexed, tube villous as ♀; anthers with obtuse appendages at apex; filaments thickened immediately below the anther: setae filamentous, slightly flattened and spreading at apex, or flattened throughout as half-aborted bracts; achene of ♂ smaller by $\frac{1}{2}$ than that of ♀.—Lag. Gen. et Sp. Nov. 33, no. 406 (1816). *Oedera trinervia*, Spr. in Bot. Gart. Halle, 63 (1800). *Broteria Contrayerva*, Spr. in Schrad. Journ. Bot. iv. t. 5 (1800), not *Millera Contrayerba*, Cav. *Nauemburgia trinervata*, Willd. Sp. Pl. iii. 2393 (1804). *Broterea trinervata*, DC. Prod. v. 636 (1836). *Broteria Sprengelii*, H. Cass. Dict. xxxiv. 304. *Flaveria trinervata*, Baillon, Hist. Pl. viii. 55 (1886). *Flaveria trinervia* (Spreng.) Mohr, Cont. Nat. Herb. vi. 810 (1901).—**ALABAMA**: adventive with ballast, Mobile County, *Mohr*, Cont. Nat. Herb. vi. 810 (1901) (hb. Geol. Surv., hb. Mohr). **TEXAS**: Barstow, *S. M. Tracy*, 8161, Oct. 1902 (hb. Gr.); Rio Grande, *Wright*, 356, Oct. 1849 (hb. Gr., hb. U. S.); near Doñiana, valley of Rio Grande, *Parry*, *Bigelow*, *Wright*, and *Schott*, 593 (hb. U. S.). **NEW MEXICO**: Mesilla, *E. O. Wooton*, 51, June, 1898, alt. 1300 m. (hb. M. B. G., hb. U. S.); Roswell, *F. S. Earle & E. S. Earle*, 304, Aug. 1900, alt. 1,200 m. (hb. M. B. G., hb. U. S.); Las Cruces, *Vasey*, 184, 1881 (hb. J. D. S., hb. U. S.). **COAHUILA**: San Carlos, *Berlandier* 2372, Nov. 1831 (hb. Gr.); Parras, *Palmer*, 686, Oct. 1880 (hb. Gr., hb. U. S., hb. J. D. S., hb. M. B. G.),

Saltillo, *Palmer*, 284, Sept. 1898 (hb. Gr., hb. U. S.); Jimulco, *Pringle*, 83, May, 1885 (hb. Gr., hb. J. D. S., hb. U. S.). NUEVA LEON: Monterey, *Enero*, 1422 & 162, 1828 (hb. Gr.). DURANGO: rich moist bottom-lands, *Palmer*, 481, Aug. 1896 (hb. Gr., hb. M. B. G., hb. U. S.). SAN LUIS POTOSI: en route from San Fernando to Santander, *Berlandier*, 839, Oct. 1839 (hb. Gr.); *Parry & Palmer*, 499, 1878 (hb. Gr., hb. M. B. G., hb. U. S.). CHIHUAHUA: *Potts* acc. *Hemsl. Biol. Cent.-Am. Bot.* ii. 216. GUANAJUATO: Jaral, *Walther Schumann*, 64, 1885 (hb. Gr., hb. J. D. S.); *Alfredo Dugès*, Nov. 1897 (hb. Gr.); Irapuato, *Pringle*, 2688, May, 1889 (hb. M. B. G.). OAXACA: *L. C. Smith*, 307, Nov. 1894 (hb. Gr.); *Conzatti & González*, 1016, Aug. 1900 (hb. Gr.), *E. W. Nelson*, 130, Sept. 1894, alt. 1,600 to 1,700 m. (hb. Gr.). HIDALGO: Cadena in rich valley, *Gregg*, 22 (hb. Gr.) & 594 (hb. Engel.). TEOTITLAN: Tecomavaca, *Pringle*, 5724, Sept. 1894 (hb. Gr., hb. U. S.); *C. L. Smith*, 264, Sept. 1894, alt. 650 m. (hb. M. B. G., hb. U. S.). TEHUACAN: *Galeotti*, 2639 acc. *Hemsl.* l. c., alt. 2,000 m. MORELOS: Jojutla, *Pringle*, 9508, June, 1901, alt. 1,000 m. (hb. Gr., hb. U. S.). YUCATAN: ditches near Progreso, *Millspaugh*, 1653, and along railroad south of lagoon, Progreso, *Millspaugh*, 1699 & 1731, Pub. Field Columb. Mus. Bot. ii. 109; downs of Progreso, *Schott*, 973, Dec. 1865, acc. *Millspaugh*, Pub. Field Columb. Mus. Bot. i. 395. CUBA: *Liebmamn*, 452 (hb. Gr.); salt marshes near Guanimas, *Wright*, 2860 (hb. Gr., hb. Engel., hb. U. S.); waste places, field and roadsides, Cieneguita, *R. Combs*, 473, Aug. 1895 (hb. Gr., hb. M. B. G.); Havana, *Palmer & Riley*, 1156, July, 1900 (hb. U. S.). VENEZUELA: Tovar, *A. Fendler*, 692, 1854-5, alt. 1,000 m. (hb. Gr.); Caracas, *A. H. Moore*, 25, Mar. 1899 (hb. Gr.). PERU: Huanuco, acc. Spr. in Schrad. Journ. Bot. iv. 186 (1800). BRITISH GUIANA: *Schomburgk*, 247, acc. *Baker* in *Mart. Fl. Bras.* vi. pt. 3, 270. BRAZIL: *Riedel*, 813 (hb. Gr.); Bahia, *Riedel*, 938, and *Luschnath*, acc. *Baker*, l. c. Cult. specimen: *Hort. Cantabr.* 1849 (hb. Gr.), *Hort. Genev.* (hb. Gr.), *Hort. Bot. Berol.* (hb. Gr.).

§ 2. Receptacle not setose.

* Heads 3- to 8-flowered.

← Annual.

++ Bracts plain.

= Ligule slender, nearly upright.

3. F. CHILENSIS, Gmel. Herbaceous, erect, .6 to .9 m. high, with a copious dichotomous branching: stem green or rubescent, branches gla-

brous or villous at nodes: leaves opposite, slightly connate, lanceolate-elliptical, narrowing at base, sometimes appearing petiolate, 3-nerved, serrate; lower leaves 6 cm. long, .4 to 5 cm. wide: cymes 2 to 2.5 cm. in diameter; branches densely scorpioid: involucral bracts .4 cm. long, oblanceolate, obtuse, subequal, exterior bracts 1 to 2, lanceolate; heads consist of one ♀ and one ♂, or usually one ♀ and 2 to 5 (sometimes 8) ♂, undeveloped ♂ often present: corolla tube villous or not; ♀ subligulate, ligule narrow, upright, acute, exceeded by lobes of style before they are reflexed, slightly more than $\frac{1}{2}$ length of ♂ corolla; ♂ corolla exceeding achene; corolla tube .3 cm. long: achene of ♀ slightly exceeding ♂ achene. — Gmel. Syst. 1269 (1796). *Flaveria peruviana*, Gmel. Syst. 1549 (1796). *Milleria chiloensis*, Hort. Reg. Paris, acc. to Juss. Gen. 187 (1789), nomen seminudum. *M. Contrayerba*, Cav. Ic. Pl. i. 2, t. 4. *Flaveria Contrayerba*, Pers. Syn. ii. 489. *Vermifuga corymbosa*, Ruiz & Pavon, Fl. Per. 114, t. 24. *Flaveria bonariensis*, DC. Prod. v. 635. *Flaveria capitata*, Juss. ex Sm. in Rees, Cycl. xv. n. 1. *Flaveria peruviana*, Juss. Gen. Pl. 187. *Milleria contrahierba*, Lam. Dict. iv. 183. *Eupatorium chilense*, Mol. Chil. 335, acc. Gay, Flora Chilena, 278. — GEORGIA: waste places among rosin wharves, Brunswick, Harper, 1521 (hb. Gr.). FLORIDA: Pensacola, Curtiss, 1504, Sept. 1886 (hb. Gr., hb. J. D. S., hb. M. B. G., hb. U. S.); Curtiss, 5, Sept. 1886 (hb. Gr.); Curtiss, 6495, July, 1899 (hb. Gr., hb. M. B. G., hb. U. S.), on waste ground. ALABAMA: Mobile, Mohr, 17, 1891 (hb. U. S.). MEXICO: Real del Monte, Berlandier; Guanajuato, Mendez, acc. Hemsl. l. c. PERU: Lima, Gaudichaud, 113 (hb. Gr.); in yards and fields of Cercado, Chaucay, Cautae, Huarocheri, Huanuci, and Cuzco provs. Commonly called "contrayerba" and "matagusanos" in Lima, and in Cuzco, "chinapaya," acc. Ruiz et Pavon, Syst. Veg. Fl. Per. et Chil. 216; in Peruvian Andes near Guancabamba, alt. 2,000 m., acc. HBK. Nov. Gen. et. Sp. iv. 285; Calloa and Lima, U. S. *Exploring expedition under Capt. Wilkes*. ECUADOR: Manobi, Eggers, 15704. BOLIVIA: Bang, 2026 (hb. Gr.); Socata, G. Mandon, 58, 1859 (hb. Gr.); Cochabamba, Bang, 968, 1891 (hb. Gr., hb. J. D. S., hb. M. B. G., hb. U. S.). CHILI: Valparaiso, Mertens (hb. Gr.); Tarajuaca, R. A. Philippi, Chili Museo National Santiago, 1888 (hb. J. D. S.); Conception, about 1709, acc. Feuille in Journ. Obs. Phys. iii. 18, t. 14. URUGUAY: Tweedie (hb. Gr.); Mendoza, Gillies, 146 (hb. Gr.). ARGENTINE REPUBLIC: Cordoba, Lorentz, 1874 (hb. Gr.); Naporta Grande, Lorentz, 1874 (hb. Gr.); Buenos Ayres, Hb. Parker (hb. Gr.); near S. Juan, Jachal, Cordoba, Tweedie, Jameson, Hieronymus, acc. Baker l. c.; near Buenos Ayres, Bacle, acc. Baker, l. c.

= Ligule oval, reflexed.

a. Leaves lanceolate, bracts 3 (sometimes 4 or 6).
 b. Leaves serrate, inflorescence leafy, not compact; stem glabrous or villous at nodes, stout.

4. *F. campestris*, nov. sp. Herbaceous: stem erect, branching dichotomously, green or rubescens, glabrous or villous at nodes: leaves linear to lanceolate, serrulate, 3-nerved, narrowing at base, slightly conuate, 2.5 to 6.5 cm. long, 1 to 2.5 cm. wide: inflorescence densely cymose, cymes corymbose-paniculate, involucral bracts 3 nearly equal, .5 cm. long; outer bracts usually 2 unequal, .1 to .6 cm. long, linear-lanceolate: flowers usually one ♀ and 3 to 4 ♂; corolla tube slightly villous, lamina of ♀ large, oval, reflexed, nearly equaling ♀ achene, which is .3 cm. long; achene of ♂ .25 cm. long.—MISSOURI: Courtney, *B. F. Bush*, 51, Sept. 1890 (hb. U. S.). KANSAS: Pawnee Rock, *A. Gordon*, Sept. 1895 (hb. Engel.); Argentine, *K. Mackenzie*, Sept. 1895 (hb. M. B. G.); *M. A. Carleton*, 740, 1896 (hb. Gr., hb. U. S.); Belvidere, *S. F. Ward*, 1897 (hb. Gr., hb. U. S.); Wichita, *B. B. Smyth*, 240, 1890, low sandy dunes and flats near river (hb. U. S.); Medicine Lodge, *Smyth*, 292, 1890, low prairies (hb. U. S.). INDIAN TERRITORY: Cherokee Outlet, *Carleton*, 505, Sept. 1891 (hb. U. S.). TEXAS: Mustang Spring, *V. Havard*, 13 (hb. U. S.); Baylor County, *Reverchon*, 22, 1879 (hb. Gr.); banks of the Brazos, Seymour, *Reverchon*, 506, 1879 (hb. J. D. S., hb. U. S.); alkali flat, Big Spring, Howard County, *V. Havard*, 13, Sept. 1881 (hb. Gr.); Antelope Hills of the Canadian, *Bigelow*, 1853-4 (hb. U. S.); Cimarron Creek, low prairies, *A. Fendler*, 536 (hb. Gr., hb. Engel.). COLORADO: Pueblo, *R. W. Woodward*, 1882 (hb. Gr.); Huerfano, *G. Engelmann*, Sept. 1881 (hb. Engel.).

b. b. Leaves remotely denticulate, tapering at base; inflorescence naked, compact; upper stem usually pubescent, stout; outer bracts large.

5. *F. ANGUSTIFOLIA*, Pers. Herb erect, 30 to 90 cm. high, branching dichotomous, upper part puberulent, branching little up to the inflorescence which is corymbiform or almost umbellate: leaves linear-lanceolate, 2.5 to 11.5 cm. long, 2.2 to 4 cm. wide, obsoletely denticulate or entire, glabrous: inflorescence naked, densely glomerate: bracts usually 3, rarely 4 or 6; two outside bracts conspicuous, unequal: 1 ♀ and 3 to 5 ♂, sometimes 6 to 8 ♂ and no ♀; corolla tube villous: achenes about equal.—Pers. Syn. ii. 489 (1807). *Milleria angustifolia*, Cav. Ic. Pl. iii. 12, t. 223 (1795). *F. integrifolia*, Moc. & Sessé, acc. to DC. Prod. v. 635. *F. elata*, Klatt, Leopold. xxiii. 146 (1887). *F. contrayerba*,

Sch. Bip. acc. to Klatt, l. c. — OAXACA: *Galeotti*, 2122, *Andrieux*, 345; Tehuacan, *Liebm*, 267 (drawing in hb. Gr.), *Schmitz*, 1027 (hb. Gr.); Coixlahuaca, *Nelson*, 1935, alt. 2,000 to 2,500 m., 1894 (hb. Gr.). PUEBLA: Puebla, *Smith*, 912, alt. 2,000 m., 1895 (hb. Gr.), *Pringle*, 4749, fields, 1894 (hb. Gr., hb. J. D. S., hb. M. B. G., hb. U. S.); Chapultepec, *Schaffner*, 16 (hb. Gr.); Hort. Mex., *Berlandier*, 640 (hb. Gr.).

*b. b. b. Leaves remotely denticulate, narrow at base; inflorescence naked, not compact; upper stem pubescent, slender; outer bracts usually conspicuous.

6. *F. intermedia*, nov. sp. Stem about 30 cm. high, slender, erect, angled, purplish, pubescent, dichotomously branching, primary branches in the two specimens all simple, terminated by a loose corymbiform glomerule resembling that of *F. campestris*: leaves minutely serrate, 1.2 to 5 cm. long, .2 to .4 cm. wide, usually opposite, sometimes whorled in axils: heads few-flowered, bracts minute to 3 mm. long: ♀ achene $\frac{1}{3}$ larger than ♀ achene. — DURANGO: Plains near Yermo, *Pringle*, 7359, Oct. 1896 (hb. U. S., hb. Gr.).

This species differs from *F. linearis* in having only three bracts, in possessing a ♀ achene much larger than the achene of ♀ flower, and in form of leaves. It differs from *F. campestris* in its very slender stem, in shape of leaves, and in size of flowers; and from *F. angustifolia* in its slender stem, comparatively loose inflorescence, and size of floral organs.

b. b. b. Leaves remotely denticulate, narrowing to a petiole-like base; stem pubescent; outer bracts minute or absent.

7. *F. robusta*, Rose. About 1.2 m. high, pubescent or glabrate below: leaves lanceolate or linear above, 4.5 to 18 cm. long, acute to acuminate, tapering into a slender petiole, 3-nerved, entire or slightly serrate: inflorescence open, corymbose; heads small, with 3 involucral bracts: flowers 3; ray 1, orbicular, about .2 cm. long; disk flowers 2: achenes .15 cm. long. — Rose, Cont. Nat. Herb. i. 337 (1895). — MEXICO: Colima, *Palmer*, 1299, Feb. 27-28, 1891 (hb. Gr., hb. J. D. S., hb. M. B. G., hb. U. S.); Armeria, *Marcus E. Jones*, 276, June 28, 1892 (hb. Gr., hb. U. S.); Chihuahua, Batopilas, *E. A. Goldman*, 240, Oct. 1898 (hb. Gr., hb. U. S.).

a. a. Leaves linear, bracts 5.

b. Stem strict.

8. *F. linearis*, Lag. Stem shrubby, erect or more commonly sprawling, branching indefinite, branches of unequal length; lower internodes short, made conspicuous by the remnants of the leaves, striate, glab-

rate: leaves linear, connate to connate-vaginate, the lower ones breaking away, typically opposite, but this character becomes inconspicuous by the presence of numerous leaves whorled in the axils of the opposite ones, entire, from 2 cm. to 10 cm. long, and from .1 to .4 cm. wide: inflorescence irregular, consisting of small loose glomerules or larger compact aggregations; involucral bracts equal, enclosing 3 to 8 flowers, usually one ligulate; outside bracts small; ligule of ♀ oval, almost equalling the long slender tube: achenes about equal, ♀ somewhat stouter than ♂. — Lag. Gen. et Sp. Nov. 33, n. 40 (1816). *F. maritima*, HBK. Nov. Gen. et Sp. iv. 285. *F. tenuifolia*, Nutt. in Journ. Acad. Phil. n. s. vii. 81. *Selloa nudata*, Nutt. in Am. Journ. Sc. v. 300 (1822). *Gymnosperma nudata*, DC. Prod. v. 312. — FLORIDA: Biscayne Bay, Palmer, 292, 1874 (hb. Gr., hb. U. S.); Miami, Garber, May, 1877 (hb. Gr., hb. U. S.); New Found Harbor Key, Pollard, Collins, and Morris, 79, Mar. 1898 (hb. U. S.); No Name Key, J. H. Simpson, 185, May, 1891 (hb. U. S.); Key West, Blodgett (hb. Gr.). CUBA: Toscano sea-shore, Wright, 2859, 1860–64 (hb. Engel., hb. U. S., hb. Gr.); Mariel, Province of Pinar del Rio among coral rocks near sea, Wm. Palmer and J. H. Riley, 713, May, 1900, and 811, June, 1900 (hb. U. S.). BAHAMAS: Red Bays, Andros, John I. and Alice R. Northrop, 462, Apr. 1900 (hb. Gr.). MEXICO: Galeotti, 23 (hb. Gr.). YUCATAN: G. F. Gaumer 1141 (hb. Gr.); Holbox Is., Bay of Honduras, Gaumer, 1886 (hb. Gr.)

Var. *latifolia*, nov. var. Stem herbaceous, erect, greenish or rubescence, slender, striate, glabrate; lower internodes not conspicuously shorter than the upper ones: leaves opposite, linear to lanceolate, conspicuously narrowed above the expanded connate base; whorls of leaves inconspicuous; leaves entire or denticulate, 2.5 cm. to 10.5 cm. long, and .4 cm. to 3 cm. wide: heads gathered in rather small glomerules which are arranged in an open quite regular corymb; heads similar to type of the species. Although this variety is very distinct in habit from the type of the species, there are intermediate and dubious forms. — FLORIDA: shore of Lake Worth near Palm Beach, Curtiss, 5524, Aug. 1895 (hb. M. B. G., hb. U. S.); Key West, Palmer, 292; Sneed's Is., Tracy, 6356, Sept. 1899 (hb. Gr., hb. U. S., hb. M. B. G.); shore of Indian River, Curtiss, 1504 (hb. Gr., hb. M. B. G.); Titusville, Brevard Co., G. V. Nash, 2301, Jul.–Aug. 1895 (hb. M. B. G., hb. U. S., hb. Gr.). YUCATAN: Cozumel Is., Gaumer, Aug. 1885 (hb. Gr.).

b. b. Stem branching copiously.

9. *F. RAMOSISSIMA*, Klatt. Stem purplish, terete, striate, glabrate,
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branching; branches diffuse, fastigiate-corymbose, leafy; upper stem somewhat villous, leaves linear-lanceolate, acute, remotely dentate, 1-nerved, 2.5 cm. long, .2 cm. wide, base connate-vaginate: peduncles and pedicels winged: heads .3 cm. long, with a bracteate base, 1-ligulate, 5-flowered: ♀ achene 1.5 mm. long, ♂ 1 mm. long. — Klatt, Leopold. xxiii. 146 (1887); *F. angustifolia*, Sch. Bip. non Pers. var. *ramosissima*, Klatt, l. c. — MEXICO: Tehuacan, Pringle, 6756, Aug. 1897, alt. 1500 m. (hb. Gr., hb. U. S.); Puebla near Tehuacan, Pringle, 7031, 1895 (hb. U. S., hb. Gr.); Liebmann, 456 and 457 (hb. Gr.).

↔ ↔ Bracts swollen.

10. *F. ANOMALA*, Rob. A glabrous annual, a span high: stem striate, angulate, much branched: leaves linear or lanceolate-linear, gradually narrowed to a slightly connate base, acute, 4 cm. to 5 cm. long, .3 cm. to .5 cm. wide: heads numerous, aggregated at the ends of the branches in dense corymbs, very small, subtended by minute dark-tipped bracts, 1-(rarely 2-) flowered; the single flower either tubular or ligulate: involucral scales of unequal breadth, lanceolate-linear or oblong, more or less narrowed but obtuse at the apex, persisting in fruit, and becoming swollen and bulbous on the back near the base; corollas bright yellow; in the tubular flowers the campanulate throat and spreading limb equaling the tube, the latter hairy on the outer surface; the ligules .2 cm. or less in length: achenes about equal. — Rob. Proc. Am. Acad. xxvii. 178 (1892). — MEXICO: San Luis Potosi, Sept. 1890, Pringle, 3669; Plains of Venegas, Pringle, 5367, Nov. 1892 (hb. U. S.); Parry, in 1878, North Mexico, 31, and in 1878 en route from San Luis Potosi to San Antonio, Texas, 500 (hb. Gr., hb. U. S.).

↔ ↔ Perennial.

↔ Inflorescence much branched; glomerules of few heads.

11. *F. Palmeri*, nov. sp. Thickened perennial root, giving rise to 1 to several more or less reclining stems; stem pale, branching copiously, glabrous: leaves linear-lanceolate, sparingly denticulate, slightly connate, 1 to 3.5 cm. long: heads in rather small cymes; cymes in compound corymbiform panicles: involucral bracts 3, equal, slightly keeled, .5 cm. long, the 1-2 outside bracts minute: lamina ♀ oval, .3 cm. long, exceeding slightly the achene; corolla tube villous. — MEXICO: San Lorenzo de Laguna, 93-114 kms. southwest of Parras, Coahuila, Palmer, 684, May, 1880 (hb. Gr., hb. U. S.).

↔ ↔ Inflorescence densely corymbose, terminal on long stalks.

12. *F. VAGINATA*, Rob. & Greenm. Perennial with stout lignescent root: stems several, ascending from a decumbent or even prostrate somewhat branched base, terete, striate, purplish, with biliniate short grayish woolly pubescence, leafy above, naked below except for the persistent and sheathing bases of the fallen leaves: internodes very short: leaves linear-lanceolate, clasping at the base, very gradually attenuate, often fascicled in the axils, 1(-3)-nerved, rather pale green, finely ciliated toward the base: heads small, closely aggregated into terminal solitary or corymbose-paniculate glomerules; these simulating the normal involucrate heads of the order: glomerules .12 to .16 cm. in breadth, subtended by a few short recurved foliaceous bracts, and containing 30 or more heads: involucral scales 3 to 4 in each head, hyaline: ray-flower solitary, conspicuous, .5 cm. long, with oblong slightly 2 to 3 toothed yellow ligule: disc flowers 5 to 7, yellow: style of ♀ 3-cleft: achenes black, lucid, about 10-nerved, ♀ 2.25 mm. long, ♀ achene 1.75 mm. long.—Rob. & Greenm. Proc. Am. Acad. xxii. 48 (1896). *E. W. Nelson*, 1933, between Coixlahuaca and Tamazulapam, Oaxaca, alt. 2,000 to 2,500 m. Nov. 1894.

* * Heads 10- to 15-flowered.

← Leaves linear to lanceolate, slightly connate.

↔ Ligulate flowers not present, inflorescence usually naked.

13. *F. LONGIFOLIA*, Gray. Rather stout, 3 to 9 dm. high, pale: leaves glabrous, broadest or not narrowed at the closely sessile base, 5 to 12.5 cm. long, entire or with rare spinulose denticulations: heads in regular very ample cymes, which are often destitute of leaves.—Gray, Pl. Fendl. 88. *Gymnosperma oppositifolia*, DC. Prod. v. 312. — MEXICO: San Luis Potosi, Parry and Palmer, 498, 1878 (hb. Gr., hb. Engel., hb. U. S.), also Pringle, 3767, July, 1891 (hb. Gr.); Parras, Coahuila, Palmer, 685, 1880 (hb. Gr., hb. J. D. S., hb. U. S.); Saltillo, Coahuila, Palmer, 304, Sept. 1898 (hb. Gr.); also Palmer, 681, 1880 (hb. Gr., hb. J. D. S., hb. U. S.); Tehuacan, Liebmann acc. Hemsl. l. c.; Berlandier, without locality (hb. Gr.); Cienega Grande, Gregg, 705, May, 1847 (hb. Engel.); Tamaulipas, Jaumam Valley, *E. W. Nelson*, 4450, June, 1898 (hb. U. S., hb. Gr.).

↔ ↔ Ligulate flowers present, inflorescence usually subtending a small whorl of leaves.

14. *F. floridana*, nov. sp. Herbaceous, erect or ascending, branching dichotomous, branches often unequal in length, striate, glabrate:

leaves opposite, linear to lanceolate, base narrowing somewhat above the expanded often connate portion, rarely denticulate, 2.5 cm. to 7.5 cm. long, .3 cm. to 1.25 cm. wide: inflorescence irregular in form; glomerules fairly compact, subtending a whorl of leaves which are usually broad and conspicuous: involucral bracts subequal; head 10- to 13-flowered, sessile, the ray flower has a large oval ligule equalling in length the slender corolla tube: achenes of ♀ and of ♂ about equal, that of the ♀ usually stouter: most nearly allied to *F. linearis*, Lag., from which it differs mainly in the number of flowers in a head, in possessing a whorl of leaves about the glomerules, and in habit; and to *F. longifolia*, Gray, from which it differs in the possession of ligulate flowers, and the whorl of leaves about the glomerule, and in habit. — FLORIDA: Sonibel Is., *H. J. Webber*, 175, Jan. 1896 (hb. U. S.); Manatee, *J. H. Simpson*, 1889 (hb. U. S.); Hog Is., *S. M. Tracy*, 7341, Nov. 1901 (hb. Gr., hb. M. B. G.).

← Leaves ovate, conspicuously perfoliate.

15. *F. CHLORAEOFOLIA*, Gray. Stem glaucous, striate, 3 to 9 dm. high: leaves ovate-oblong to narrowly lanceolate, broadest and connate or connate-perfoliate at base, glabrous, 2.5 to 9 cm. long, 1.2 to 3.5 cm. wide: heads more or less clustered in a broad and open naked pedunculate compound terminal corymbiform cyme: heads 11- to 13-flowered, involucral bracts 5, the 2 smaller and outer bracts quite distinct; ray flowers 0, disk flowers .6 cm. long; 2 to 3 small pales on most achenes (4 acc. Gray). — Gray, Pl. Fendl. 88 (1849), & Syn. Fl. ii. pt. 2, 353. — TEXAS: Screw Bean, *G. C. Neally*, 688, 1889 (hb. U. S.); on the banks of the Rio Grande, *Wright*, 357 (hb. Gr.); below Doñana, valley of Rio Grande, *Parry, Bigelow, Wright*, and *Schott*, 592 (hb. U. S.). MEXICO: Coahuila, *Palmer*, 682, 1880 (hb. Gr., hb. J. D. S., hb. M. B. G., hb. U. S.), and 2083, 1897 (hb. Gr., hb. J. D. S., hb. M. B. G.).

DOUBTFUL AND EXCLUDED SPECIES.

F. HUMILLIMA, Sch. Bip. in *Linnaea*, xxxiv. 529 (1865-66), without description.

F. SPICATA, Juss. mss. acc. Smith in *Rees, Cyclopedia*, xv. Collected by Dombey in Peru. Acc. to Hook. f. & Jacks., in *Index Kewensis*, it is *Piqueria artemisioides*.

F. PERUVIANA, Juss. acc. DC. Prod. v. 635, is *Piqueria artemisioides*.

F. PERFOLIATA, Klatt, Leopold. xxiii. 146 (1887), is *Desmanthodium perfoliatum*.